Name _____ Date _____

LESSON 12.1

Study Guide

For use with pages 792–801

GOAL **Identify solids.**

Vocabulary

A **polyhedron** is a solid that is bounded by polygons, called **faces,** that enclose a single region of space.

An **edge** of a polyhedron is a line segment formed by the intersection of two faces.

A **vertex** of a polyhedron is a point where three or more edges meet.

The **bases** of a prism are congruent polygons in parallel planes. The **base** of a pyramid is a polygon.

Theorem 12.1 Euler's Theorem: The number of faces (F), vertices (V), and edges (E) of a polyhedron are related by the formula $F + V = E + 2$.

A polyhedron is **regular** if all of its faces are congruent regular polygons.

A polyhedron is **convex** if any two points on its surface can be connected by a segment that lies entirely inside or on the polyhedron.

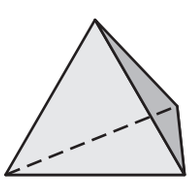
A polyhedron is *concave* if any two points on its surface can be connected by a segment that goes on the outside of the polyhedron.

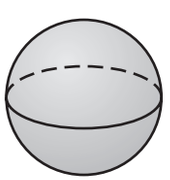
Platonic solids are five regular polyhedra that include the regular tetrahedron, cube, regular octahedron, regular dodecahedron, and regular icosahedron.

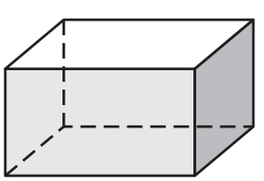
A **cross section** is the intersection of a plane and a solid.

EXAMPLE 1 Identify and name polyhedra

Tell whether the solid is a polyhedron. If it is, name the polyhedron and find the number of faces, vertices, and edges.

a. 

b. 

c. 

Solution

a. The solid is formed by polygons, so it is a polyhedron. The base is a triangle, so it is a triangular pyramid. It has 4 faces, 4 vertices, and 6 edges.

b. The sphere has a curved surface, so it is not a polyhedron.

c. The solid is formed by polygons, so it is a polyhedron. The two bases are congruent rectangles, so it is a rectangular prism. It has 6 faces, 8 vertices, and 12 edges.

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LESSON 12.1

Study Guide *continued*

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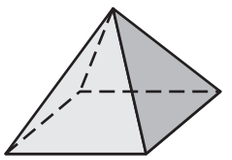
EXAMPLE 2 Use Euler's Theorem with Platonic solids

Find the number of faces, vertices, and edges of the polyhedron. Check your answer using Euler's Theorem.



Solution

By counting on the diagram, the tetrahedron has 5 faces, 5 vertices, and 8 edges. Use Euler's Theorem to check.

$F + V = E + 2$ Euler's Theorem

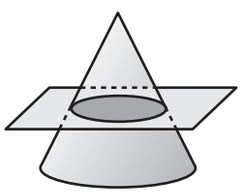
$5 + 5 = 8 + 2$ Substitute.

$10 = 10$ This is a true statement. So, the solution checks.

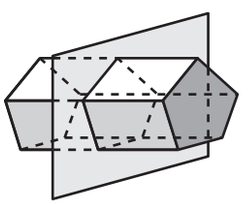
EXAMPLE 3 Describe cross sections

Describe the shape formed by the intersection of the plane and the solid.

a.



b.



Solution

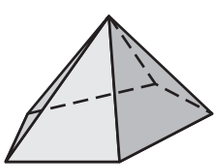
a. The cross section is a circle.

b. The cross section is a pentagon.

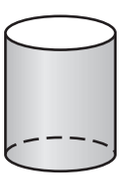
Exercises for Examples 1, 2, and 3

Tell whether the solid is a polyhedron. If it is, name the polyhedron and find the number of faces, vertices, and edges.

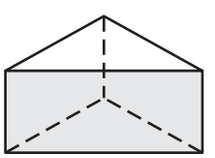
1.



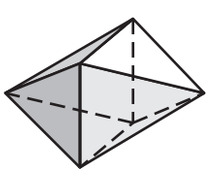
2.



3.

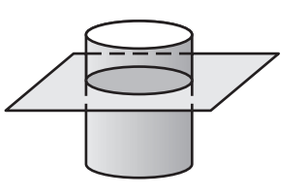


4. Find the number of faces, vertices, and edges of the polyhedron. Check your answer using Euler's Theorem.

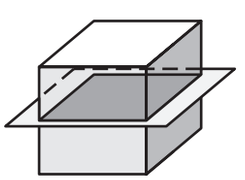


Describe the shape formed by the intersection of the plane and solid.

5.



6.



7.